Level of rumen degradable intake protein (DIP) in high-grain diets fed to feedlot lambs.

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Impact statement

Degradable intake protein does not appear to limit performance of feedlot lambs fed a corn based diet containing 7.3% (dry matter basis) undegradable intake protein.

Summary

Eighty Hampshire crossed ram lambs (85.0 ± 0.7 lb initial weight) were used to determine the degradable intake protein level in corn-based diets. Dietary treatments were 0% urea-0% SBM, 0.33% urea-3% SBM, 0.67% urea-6% SBM, and 1.0% urea-9% SBM. A quadratic (*P* = 0.09) response to dry matter intake occurred, lambs consuming the 0.33 and 0.67% diets had the highest intakes. A similar response (quadratic; *P* = 0.10) occurred when expressing intake as a percentage of body weight, peaking at 0.33 and 0.67% urea. There was a tendency (quadratic; *P* = 0.12) for hot carcass weight to decrease from a peak at the 0.33% diet. Rib-eye area linearly (*P* = 0.05) decreased as level of DIP increased. Leg score responded cubically (*P* = 0.07), lambs consuming 1.0% urea had the greatest leg score.

Introduction

Little research has been conducted to determine the metabolizable protein requirements for lambs. The Beef NRC (1996) came out with a metabolizable protein (MP) system where MP is the sum of microbial protein and rumen undegradable protein (UIP; bypass protein). Degradable intake protein (DIP) is incorporated into microbial protein; microbial protein and undegradable intake protein flow to the small intestine where digestion takes place. Research conducted at NDSU on lambs fed corn-based diets found that an increase in dietary UIP (5.4 to 7.3%) increased lamb feed efficiency; however, an increase in dietary DIP (8.9 to 11.0%) did not change performance leaving the optimal level of DIP in high-grain diets in question. The lack of response with additional DIP in high-grain diets is converse to the response generally seen in beef cattle fed high-grain diets. The objective of this study was to determine the optimal level of DIP in high-grain finishing lamb diets.

Materials and Methods

In determination of the optimal level of DIP in corn-based diets fed to finishing lambs, 80 Hampshire crossed ram lambs were fed for 38 days (3 pens/treatment) and 60 days (2 pens/treatment). Lambs were weighed on three consecutive days, blocked by weight, and allotted randomly to dietary treatment. Lambs (4/pen) were housed at the NDSU Animal Research Center in Fargo. Diets contained dried beet pulp pellets as the roughage source instead of hay to avoid feed sorting problems and insure intake of a balanced diet. Urea and soybean meal were the degradable intake protein sources; whereas, feathermeal and bloodmeal (4:1; feathermeal:bloodmeal) were the undegradable intake protein sources. Dietary treatments (Table 1) were formulated to contain a minimum 13.4% crude protein, 0.7% Ca, 0.3% P, 0.6% K, and 2.05 Ca:P. Level of UIP was held constant at 7.3% across all treatments. Final weights were an average of three consecutive day weights. Lambs were marketed for slaughter when they were thought to have approximately 0.2 inch fat thickness. Carcass data was taken on all lambs.

Results and Discussion

Feeding urea up to 1.0% in a high-corn diet did not appear to be detrimental to lamb growth (Table 2). Dry matter intake responded quadratically (P = 0.09) being greatest with 0.33% and 0.67% urea and lowest with 1.0% urea in the diet. A similar response (quadratic; P = 0.10) occurred when dry matter intake was expressed as a percentage of body weight. No other treatment affects on performance occurred; gain and feed efficiency were similar among treatments.

Rib-eye area decreased linearly (P = 0.05) with increase in level of DIP. Leg score responded quadratically (P = 0.07), with lambs consuming the 1.0% urea diet having the highest leg scores. There were no other affects on carcass characteristics (Table 3) with respect to treatment.

Conclusion

The optimal level of DIP fed to feedlot lambs with the ability to gain at least 1.06 lb/day does not appear to be greater than 6.1% of the diet dry matter; however, feeding levels between 6.1 and 11.0% does not affect gain or feed efficiency.

Table 1. Formulated dietary treatments

	Level of rumen degradable intake protein, % dry matter basis			
Item	6.1	7.7	9.4	11.0
Dry-rolled corn	74.0	71.5	69.0	66.5
Beet pulp pellets	12.5	12.5	12.5	12.5

Molasses	5.0	5.0	5.0	5.0
Soybean meal	0.0	3.0	6.0	9.0
Urea	0.0	0.33	0.67	1.00
Feathermeal	3.48	3.00	2.52	2.04
Bloodmeal	0.87	0.75	0.63	0.51
Supplement	4.15	3.92	3.68	3.45
Protein [a]				
Crude	13.4	15.0	16.7	18.3
Rumen degradable	6.1	7.7	9.4	11.0
Rumen undegradable	7.3	7.3	7.3	7.3
Metabolizable	8.6	8.7	8.7	8.8

[a] Calculated from book values

Table 2. Effect of treatment on performance.

	Level of rumen degradable intake protein, % dry matter basis				
Item	6.1	7.7	9.4	11.0	Error
Weight, lb					
Initial	84.8	85.2	85.0	84.8	0.7
Final	132.9	133.6	133.4	132.6	1.6
Dry matter intake					
lb/day [a]	3.71	3.79	3.80	3.63	0.07
% of body weight [a]	3.40	3.46	3.47	3.33	0.06
Average daily gain, lb	1.06	1.08	1.08	1.06	0.03
Gain:Feed	0.285	0.282	0.282	0.291	0.005

Feed:Gain [b]	3.51	3.54	3.54	3.44

[a] Quadratic response to treatment (*P* < 0.10)

[b] Feed:Gain calculated as Gain:Feed. Feed:Gain is a reciprocal of Gain:Feed

Table 3. Effect of treatment on carcass characteristics.

	Level of rumen degradable intake protein, % dry matter basis				
Item	6.1	7.7	9.4	11.0	Error
Hot carcass weight, lb	65.6	67.6	65.6	64.8	0.8
Fat thickness, in	0.19	0.18	0.19	0.17	0.02
Rib-eye area, in^2 [a]	2.67	2.59	2.51	2.50	0.06
Bodywall thickness, in	0.78	0.74	0.78	0.69	0.05
Marbling [b]	427	397	387	396	17
Flank streaking [b]	461	445	453	459	12
Yield grade	2.26	2.18	2.30	2.06	0.18
Leg score [c]	11.4	11.4	11.3	11.7	0.1
Conformation score	11.4	11.3	11.0	11.3	0.2

[a] Linear response to treatment (*P* = 0.05)

[b] Marbling or flank streaking score of 400 = small (low choice)

[c] Cubic response to treatment (*P* = 0.07)